REMARKS

Reconsideration and allowance of this application are respectfully requested in light of the above amendments and the following remarks.

Formal Matters

The Office Action has not acknowledged receipt of the Claim for Priority and all certified copies of the priority documents submitted therewith. Written acknowledgment in the next Office Communication is respectfully requested.

The Office Action has acknowledged consideration of the Information Disclosure Statements filed September 29, 2000 and June 19, 2001.

Claims

Claims 35, 39, and 41 have been canceled without prejudice or disclaimer, because these claims do not relate to the elected Species A.

Claims 36, 40, 42, and 48 are pending.

Claims 36, 40, and 42 have been amended to replace a limitation regarding the ratio of the depth of the second relief pattern to the first relief patter with the limitation "said first relief pattern has a wavelength depending phase amplitude $a_1(\lambda)$, said second relief pattern has a wavelength depending phase amplitude $a_2(\lambda)$, said diffractive element has a phase amplitude

$a(\lambda)$ which is a sum of said phase amplitudes $a_1(\lambda)$ and $a_2(\lambda)$ and includes at least one peak value within the wavelength to be used." This limitation is supported at least at application page 22, lines 5-11, wherein equation (12) depicts the claimed sum, and FIG. 10, wherein the solid curve illustrates that the phase amplitude of the diffractive optical element, i.e., the claimed sum, according to a first embodiment, has a peak value.

New claim 48 is directed to a diffractive optical element according to present claim 36 wherein one of the three optical regions is formed by air or an equivalent, and is supported at least at application page 29, lines 6-9.

35 U.S.C.§112 ¶2 Rejection

Claims 35 and 36 stand rejected on the grounds that the recitation of "phase shift function" is confusing, in error and indefinite since it is not clear what is being considered as the phase shift function.

Claim 35 has been canceled and therefore the rejection is mooted with respect to this claim. Claim 36 has been amended to remove the "phase shift function" language and present claim 36 is considered to be definite. Therefore, the rejection with respect to claim 36 is also mooted.

Prior Art Rejections

I. Claim 35 is rejected under 35 U.S.C. 102(b) as being anticipated by Knop (U.S. Patent No. 4,426,130).

The Office Action Position

Claim 35 has been canceled and therefore the rejection is mooted.

II. Claims 36 and 40-42 stand rejected under 35 U.S.C. §103(a) over Sakata (U.S. 4,729,640).

Claim 41 has been canceled, and therefore the rejection is mooted with respect to this claim.

As noted above, claims 36, 40, and 42 have been amended to replace a limitation concerning the ratio of the depths with a limitation concerning the phase amplitude $a(\lambda)$.

It is respectfully submitted that Sakata fails to provide any disclosure, suggestion, or motivation that the diffractive optical element has a phase amplitude which is defined by a sum of the phase amplitudes of the first and second relief patterns and includes a peak value, as now recited by present claims 36, 40, and 42. Accordingly, it is submitted that Sakata provides no teaching, suggestion, or motivation, that would have rendered the presently claimed invention obvious to a person of ordinary skill in the art.

Claim 48 depends from claim 36 and defines one of the first, second and third optical regions as being formed by one of air or material equivalent to air and having a refractive index of

substantially 1. This subject matter departs even further from the teachings of the applied art, so that this claim is also considered to define patentable subject matter.

For at least these reasons, it is respectfully submitted that claims 36, 40, 42 and 48 are directed to allowable subject matter.

II. Claim 39 stands rejected under 35 U.S.C. §103(a) over Knop (U.S. 4,426,130).

Claim 39 has been canceled and this rejection is therefore mooted.

II. Claims 35, 36 and 39-42 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 3, and 4 of U.S. Pat. No. 6,157,488.

Claims 35, 39, and 41 have been canceled and therefore the rejection is mooted with respect to these claims.

Claims 36, 40, and 42 have been amended to recite the above-described limitation concerning phase amplitude. It is respectfully noted that claims 1, 3, and 4 of U.S. Pat. No. 6,157,488 fail to recite a limitation that the diffractive optical element has a phase amplitude which is defined by a sum of the phase amplitudes of the first and second relief patterns and includes a peak value, as now recited by present claims 36, 40, and 42.

Accordingly, it is submitted that the double patenting rejection is unwarranted against present claims 36, 40, and 42.

Conclusion

It is respectfully submitted that all grounds of rejection stated in the Final Rejection have been overcome and present claims 36, 40, 42 and 48 are allowable. It is respectfully submitted that the present application is in condition for allowance, and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to kindly telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

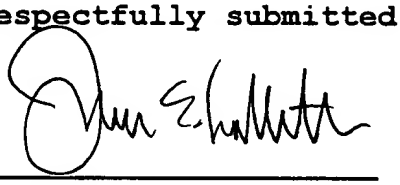

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EXHIBIT I

36. (Amended) A diffractive optical element comprising:

a first optical region made of a first optical material which is substantially transparent to light within a wavelength range to be used and has a refractive index n_1;

a second optical region made of a second optical material which is substantially transparent to said light but is different from said first optical material and has a refractive index n_2;

a third optical region made of a third optical material which is transparent to said light but is different from said second optical material and has a refractive index n_3, said first, second and third optical regions being arranged to be brought into contact with each other or being arranged close to each other;

a first relief pattern formed in a boundary surface between said first and second optical regions and having a first pitch distribution and a depth d_1; and

a second relief pattern formed in a boundary surface between said second and third optical regions and having a second pitch distribution which is substantially identical with said first pitch distribution of the first relief pattern and a second depth d_2, said first and second relief patterns being substantially aligned in a direction of an optical axis of the diffractive optical element, wherein [when a ratio of the depth of the second

relief pattern to the depth of the second relief pattern is $\alpha(=d_2/d_1)$, a wavelength of the light within the wavelength range to be used is λ, a shortest wavelength of the wavelength region to be used is λ_1, and a longest wavelength of the wavelength range to be used is λ_2, the following condition is satisfied:

$$|\Delta N(\lambda_2)| > |\Delta N(\lambda_1)| > 0;\ \lambda_2 > \lambda_1$$

wherein

$$\Delta N(\lambda) = \{n_1(\lambda)-n_2(\lambda)\} + \alpha\{n_2(\lambda)-n_3(\lambda)\};$$

wherein a ratio of the depth of the second relief pattern to the depth of the first relief pattern $\alpha(=d_2/d_1)$ is set such that a phase shift function of the first relief pattern and a phase shift function of the second relief pattern are canceled out by each other] said first relief pattern has a wavelength depending phase amplitude $a_1(\lambda)$, said second relief pattern has a wavelength depending phase amplitude $a_2(\lambda)$, and said diffractive element has a phase amplitude $a(\lambda)$ which is a sum of said phase amplitudes $a_1(\lambda)$ and $a_2(\lambda)$ and includes at least one peak value within the wavelength to be used.

40. (Amended) A diffractive optical element comprising:

a first optical region made of a first optical material which is substantially transparent to light within a wavelength range to be used and has a refractive index n_1;

a second optical region made of a second optical material which is substantially transparent to said light but is different from said first optical material and has a refractive index n_2;

a third optical region made of a third optical material which is transparent to said light but is different from said second optical material and has a refractive index n_3, said first, second and third optical regions being arranged to be brought into contact with each other or being arranged close to each other;

a first relief pattern formed in a boundary surface between said first and second optical regions and having a first pitch distribution and a depth d_1; and

a second relief pattern formed in a boundary surface between said second and third optical regions and having a second pitch distribution which is substantially identical with said first pitch distribution of the first relief pattern and a second depth d_2, said first and second relief patterns being substantially aligned in a direction of an optical axis of the diffractive optical element, wherein [when a ratio of the depth of the second relief pattern to the depth of the second relief pattern is $\alpha(=d_2/d_1)$, a wavelength of the light within the wavelength range to be used is λ, a shortest wavelength of the wavelength region to be used is λ_1, and a longest wavelength of the wavelength range to be used is λ_2, the following condition is satisfied:

$$|\Delta N(\lambda_2)| > |\Delta N(\lambda_1)| > 0;\ \lambda_2 > \lambda_1$$

wherein

$$\Delta N(\lambda) = \{n_1(\lambda)-n_2(\lambda)\} + \alpha\ \{n_2(\lambda)-n_3(\lambda)\};]$$ said first relief pattern has a wavelength depending phase amplitude $a_1(\lambda)$, said second relief pattern has a wavelength depending phase amplitude $a_2(\lambda)$, and said diffractive element has a phase amplitude $a(\lambda)$ which is a sum of said phase amplitudes $a_1(\lambda)$ and $a_2(\lambda)$ and includes at least one peak value within the wavelength to be used, wherein when an average refractive index of a composite relief structure constituted by the first and second relief patterns is n_0, a thickness of the diffractive optical element is D, and a smallest pitch of the relief patterns is T, the following condition is satisfied:

$$\frac{2\pi\lambda D}{n_0 T^2} < 1.$$

42. A diffractive optical element comprising:

a first optical region made of a first optical material which is substantially transparent to light within a wavelength range to be used and has a refractive index n_1;

a second optical region made of a second optical material which is substantially transparent to said light but is different from said first optical material and has a refractive index n_2;

a third optical region made of a third optical material which is transparent to said light but is different from said second optical material and has a refractive index n_3, said first, second and third optical regions being arranged to be brought into contact with each other or being arranged close to each other;

a first relief pattern formed in a boundary surface between said first and second optical regions and having a first pitch distribution and a depth d_1; and

a second relief pattern formed in a boundary surface between said second and third optical regions and having a second pitch distribution which is substantially identical with said first pitch distribution of the first relief pattern and a second depth d_2, said first and second relief patterns being substantially aligned in a direction of an optical axis of the diffractive optical element, wherein [when a ratio of the depth of the second relief pattern to the depth of the second relief pattern is $\alpha(=d_2/d_1)$, a wavelength of the light within the wavelength range to be used is λ, a shortest wavelength of the wavelength region to be used is λ_1, and a longest wavelength of the wavelength range to be used is λ_2, the following condition is satisfied:

$$|\Delta N(\lambda_2)| > |\Delta N(\lambda_1)| > 0; \ \lambda_2 > \lambda_1$$

wherein

$\Delta N(\lambda) = \{n_1(\lambda)-n_2(\lambda)\} + \alpha \{n_2(\lambda)-n_3(\lambda)\};]$ said first relief pattern has a wavelength depending phase amplitude $a_1(\lambda)$, said second relief pattern has a wavelength depending phase amplitude $a_2(\lambda)$, and said diffractive element has a phase amplitude $a(\lambda)$ which is a sum of said phase amplitudes $a_1(\lambda)$ and $a_2(\lambda)$ and includes at least one peak value within the wavelength to be used, wherein when a shortest wavelength of the wavelength range to be used is λ_1, a longest wavelength of the wavelength range to be used is λ_2, and a middle wavelength between λ_1 and λ_2 is λ_0 $(=(\lambda_1 + \lambda_2)/2)$, the following condition is satisfied:

$$\lambda_2 - \lambda_1 > 0.05\lambda_0.$$